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A Neuro-Financial Approach to Investor Behaviour towards Market Crash.

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Abstract

Neurofinance is the interdisciplinary field that integrates neuroscience and behavioural finance to examine the decision-making mechanism. This field combines insights from neuroscience, psychology, and economics to provide a more nuanced understanding of investor behaviour, which often deviates from the perfectly rational models assumed in traditional finance. This study examines the neuro-psychological factors involved in investor behaviour during unpredictable occurrences with significant market impacts. The data was collected from 200 active retail investors in Kerala who have been regularly buying and selling stocks over the past six months, completing at least five transactions per month. The study employed Structural Equation Modeling (SEM) to examine the relationships between biases, heuristics, neurotransmitters, and investor behaviour. The results confirm that biases, heuristics, and neurotransmitters significantly influence investor behaviour during unexpected market crash, while herding behaviour has no substantial effect.

Keywords: Neurofinance, investor, market, etc.,

This research underscores the importance of more holistic approaches, combining both rational and neuro-psychological aspects to understand investor behaviour in dynamic market conditions.

I. INTRODUCTION

The internet, social media platforms, and instant messaging advancements have made it possible to share even minor events or pieces of information globally within seconds. As a result, the impact of these events is intensified as reactions, decisions, and actions are triggered in a short span of time, creating ripple effects in financial markets, political landscapes, and public opinion (Ole, Lindaas, Kenneth, & Pettersen, 2016).a significant decline in stock market indices causes a pivotal shift in investor behaviour. The market crashes may be triggered by events such as natural disasters, corporate bankruptcies, financial scandals, or other negative occurrences that tend to incite panic and emotional distress among investors. In such crises, a clear understanding of the investor behaviour is vital for foreseeing market trends and reactions. Emotions, rather than careful thinking or thorough analysis, often drive quick decisions in these situations. Many investors may react impulsively, while some take a contrarian approach, aiming to benefit from market mispricing. Emotions such as fear, panic, and herd mentality often influence investor behaviour during sudden events, leading to high volatility and sharp market changes. On the other hand, our nervous system is highly sensitive and has a strong influence on human behaviour, including responses to sudden events. Specifically, the nervous system responds swiftly to unexpected or unpredictable events, and the brain plays a crucial role in managing these situations. Strong signals in the brain can lead to quick decisions, showing how much the brain influences individual investment choices (Mudunuri, Padmanabha, Raju, Chokkamreddy, & Prakash, 2024). Neurotransmitters, which are chemicals in the brain, send signals between nerve cells and are central to this process (Christopher & Cronin, 2022). Certain neurotransmitters play a significant role in the neural mechanism during unexpected events. One of the transmitters heavily involved in reward and motivation pathways is dopamine. It also plays a role in motor control, learning, and attention (Speranza, L., di Porzio, U., Viggiano, D., de Donato, A., & Volpicelli, F., 2021). Another neurotransmitter, serotonin, contributes significantly to feelings of well-being and happiness. It's also involved in regulating mood, sleep, appetite, and digestion (Pau, Celada., M., Victoria, Puig., & Francesc, Artig, 2013). Epinephrine is a stress hormone that triggers the "fight or flight" response. It increases heart rate, blood pressure, and energy supplies (Richard, J., Wurtman., 2002). Similar to epinephrine, norepinephrine is involved in the stress response. It also helps regulate attention, focus, and alertness (Qingyuan Meng, Alvaro L. Garcia-Garcia, Alex Dranovsky, & E. David Leonardo, 2023).

Behavioural finance is a field of study that explores how psychological factors, and cognitive biases influence financial decision-making and market outcomes(Azam, Anwar, Khan, Muhammad, & Waqas., 2024). According to C. Giovanni, Galizia., Pierre-Marie, & Lledo. (2013), neuroscience is the scientific study of the nervous system, which includes the brain, spinal cord, and networks of neurons that regulate and control behaviour, cognition, sensation, and motor functions. Integrating neuroscience techniques, such as brain imaging and physiological measurements, helps identify the neural correlates of financial decisions, ultimately enhancing our understanding of how emotions like fear and greed can impact market dynamics.

Social science requires a more complex examination of the neuropsychological mechanism. Examining the neurotransmitters, the chemical messengers in the human brain that generate signals from neurones to neurones, is particularly complex. Advanced neuroimaging and biochemical methods typically measure neurotransmitter activity, replacing the traditional scales or questionnaires used for behavioural or psychological assessments. Positron Emission Tomography (PET) scans, functional magnetic resonance imaging (fMRI), cerebrospinal fluid (CSF) analysis, blood and salivary biomarkers, and electroencephalography (EEG) are the most accepted clinical methods to measure neurotransmitter activity.

Recently, researchers have introduced new methods similar to traditional surveys, specifically designed to measure neural activities. Mumtaz Ahmad, Asma Tahir, & Nadeem Sohail (2018) suggested a simpler neurotransmitter scale that focusses on key neurotransmitters such as dopamine, serotonin, epinephrine, and norepinephrine, consisting of just 16 items. This scale is easy to use and does not require specialized knowledge for measuring neurotransmitters. Many studies have adopted this scale and found it effective in delivering reliable results.

This current study focuses on the influence of various psychological and neurological factors on investor behaviour toward unexpected events among retail investors in Kerala. The psychological factors under investigation include emotional bias, cognitive bias, heuristics, and herd behaviour—all of which play a significant role in decision-making processes during unpredictable market conditions. It highlights the importance of controlling both psychological and neurological influences to improve decision-making processes during market turbulence.

Review of Literature

Neurofinance integrates neuroscience, psychology, and finance to understand the cognitive and emotional processes underlying financial decision-making(Steven, G., Sapra., Paul, J., Zak. , 2008). This emerging discipline challenges traditional finance theories by incorporating insights from brain science to explain why individuals often deviate from rational financial behavior.

Investor behavior tends to differ significantly between normal market conditions and during unpredictable market fluctuations. In normal markets, investors are generally guided by rational decision-making, relying on financial analysis, historical trends, and logical assessment of risks and rewards. Cognitive biases may still influence behavior, but the level of emotional response is typically lower, allowing for more controlled, methodical decision-making. However, during market crash— unexpected occurrences that cause massive market disruption—emotional and neuropsychological factors dominate(Azam, Anwar, Khan, Muhammad, & Waqas., 2024). Fear, panic, and uncertainty often override rational thinking, leading to impulsive actions such as panic selling or holding onto assets out of fear of loss. In these situations, neurotransmitters like dopamine, serotonin, epinephrine and norepinephrine heighten stress responses, causing investors to focus on immediate survival rather than long-term strategy(Ahmad, Mumtaz., 2018), (Khan A & Mubarak MS, 2020). Emotional bias has been studied extensively, with research showing that emotions like fear, greed, and overconfidence can severely disrupt rational financial decision-making. Syed, Ibtasam, & Shafqat (2024)demonstrated that emotional responses to market volatility often led to impulsive actions, such as panic selling or holding onto losing investments due to loss aversion. Cognitive biases have also been well-documented, with biases like confirmation bias (Mudunuri, Padmanabha, Raju, Chokkamreddy, & Prakash, 2024)and anchoring bias (Sahi SK, 2017)influencing how investors interpret market information. These biases distort rational analysis, leading investors to make suboptimal decisions based on incomplete or skewed data. Furthermore, heuristics—the mental shortcuts used to simplify decision-making—have been examined in studies byMarcelina, Piotrowski., Christian, & Bünnings. (2022), which highlight both the advantages and pitfalls of these shortcuts. While heuristics like representativeness or availability can speed up decision-making in uncertain market conditions, they often result in oversimplification, increasing the likelihood of errors in judgment. Collectively, the literature underscores the critical role these psychological factors play in driving investor behavior, particularly during periods of high market uncertainty.

The unpredictability and shock of unpredictable events also lead to herd behavior, as investors tend to follow the crowd in hopes of minimizing losses(Adnan Ali, Farzand Ali Jan, & Mughira Jehanzeb, 2015). This contrast between calm, calculated behavior in normal markets and emotionally driven, often irrational actions during market crash

highlights the powerful role of neuropsychological factors in extreme market conditions.

This study sheds light on the underlying biological and psychological processes that drive behavior under stress. Understanding this mechanism is crucial for developing strategies, such as behavioral interventions and decision-making frameworks, to help investors better manage their emotions and cognitive biases during market shocks. Additionally, this research contributes to the growing field of neurofinance, offering insights that can improve financial education programs, enhance risk management practices, and ultimately promote more resilient financial behavior during unpredictable market crises.

Objective of the Study

1. To examine the influence of neuropsychological factors on investor behaviour towards market crash.

Research Methodology

The present study adopts a descriptive research design to investigate the influence of neuropsychological factors on investor behaviour during unpredictable market events. The data for the study were collected through e-mail by using a structured questionnaire that was divided into sections covering demographic information, neurofinancial factors such as influence of neurotransmitters, emotional, cognitive, and social influences, and investment behaviour. This study adopted the measurement scale from validated instruments in previous literature. Specifically,

- **Neuro Psychological Factors:** Ahmad, Tahir, & Sohail (2018),Tversky & Kahneman (1974), Huberman (2001).
- **Investment behaviour:** Garg & Pandey (2020), Akhtar & Das (2018), Markowitz (1952), Grable & Lytton (1999).

The sample size is determined based on the Sample - to - Item Ratio, where the Ratio should not be less than 5 to 1 (Gorsuch, 1983). As per this sample size 195 is enough for further analysis, Accordingly the data has been collected from 200 retail investors who active in buying and selling of stocks over the past 6 months and doing minimum of 5 stock transactions per month. The study is focused on retail investors of Kerala only. The multi- stage sampling technique is used as randomly selected 4 districts Kasargod, Kozhikode, Trissur, Ernakulam and Trivandrum. Then approached one investor from each district and completed data collection from 40 investors from each district through snowball sampling.

The study integrating various dimensions of psychology and neuroscience to learn the neural and psychological mechanisms in investor behaviour towards an unpredicted

event. The influence of these factors was examined through Partial Least Squares Structural Equation Modelling (PLS-SEM) by using SMART – PLS.

Results and Discussions

Demographic Analysis: Table 1 shows the demographic profile of the respondents. Most of the respondents are men (71.79%), while one-fourth of the respondents are women (28.21%). Unmarried respondents account for 77.94% of the total. Majority of the respondents (52.30%) are in the age group of 20-29. Most of the respondents (48.20%) are postgraduates, and 60% of the respondents are private employees. The largest proportion of respondents (40%) belongs to the income category of below 30,000. The profile of the respondents shows that the respondents are mostly young, educated men who are unmarried and work in private jobs. Many of them earn average level of income, which may influence their spending habits and lifestyle choices.

Table 1. Percentage distribution of demographic variables

Variable Name	Description	Percentage
Gender	Men	71.79
	Women	28.21
Age (Years)	20-29 years	52.30
	30-39 years	38.46
	40-49 years	5.64
	50-59 years	3.6
Marital Status	Single	77.94
	Married	22.06
Education	Higher Secondary	2.05
	Under Graduation	36.41
	Post-Graduation	48.20
	Diploma	13.34
Occupation	Govt. Employees	16.41
	Pvt. Employees	60.00
	Business	16.41
	Home maker	7.18
Personal Income	Up to 30000	40
	Rs.30001-60000	23.58
	Rs.60001-100000	20
	Above 100000	16.42

Reliability and Validity: This study prioritized the accuracy of its measurements by carefully examining both reliability and validity. The initial assessment of individual item reliability, using measurement item loadings, showed promising results with all

values exceeding 0.50. Recognizing the limitations of Cronbach's α as highlighted by (Peterson & Kim, 2013), Composite Reliability was employed to provide a more robust evaluation of internal consistency. The Average Variance Extracted (AVE) values for all factors exceed the generally accepted threshold of 0.50, indicating that the constructs capture enough variance from their respective measures. Emotional Biases (EB) have an AVE of 0.537, which is slightly above the threshold, showing acceptable convergent validity. Cognitive Biases (CB) with an AVE of 0.646 and Herding (HR) with an AVE of 0.634 exhibit good convergent validity, indicating that a significant portion of the variance is attributable to the constructs themselves rather than measurement error.

Moreover, Heuristics (HU), which has an AVE of 0.714, demonstrates strong convergent validity, suggesting that the items measuring heuristics are highly correlated with the underlying construct. Neurotransmitters (NS) and Investor Behaviour (IB) also show good convergent validity with AVEs of 0.571 and 0.613, respectively. Overall, the AVE values for all factors suggest that the constructs are well-defined, and the items used to measure them capture relevant variance effectively.

Table 2. Measurement model

Factors	**Average variance extracted (AVE)**	**Cronbach's alpha**	**Composite reliability**
Emotional Biases (EB)	0.537	0.756	0.770
Cognitive Biases (CB)	0.646	0.745	0.760
Heuristics (HU)	0.714	0.820	0.832
Herding (HR)	0.634	0.723	0.725
Neurotransmitters (NS)	0.571	0.905	0.907
Investor Behaviour (IB)	0.613	0.892	0.909

To further enhance the robustness of the findings, the study assessed discriminant validity by examining the correlation matrix of the constructs. Following the method proposed by For nell and Larcker (1981), the analysis confirmed that the square root of the Average Variance Extracted (AVE) for each construct was greater than the correlations between the constructs. As shown in Table 4, this result indicates that each construct is more strongly correlated with its own indicators than with those of other constructs, thereby confirming adequate discriminant validity within the extended model.

Path analysis: The Neurofinancial Approach to Investor Behaviour aimed to explore how various biases, emotions, and neurological factors influence investor behavior during rare and unpredictable events that have severe consequences. Investors' responses to such events are not entirely rational, there are some psychological and neurological factors also influence investor behaviour. The hypotheses test results (Table 5) provide an insight in to the influence of Emotional Biases (EB), Cognitive Biases (CB), Heuristics (HU), Herding (HR), and Neurotransmitters (NS) on Investor Behavior (IB) during market crash.

Table 3. Path Coefficients

Hypothesis	**Paths**	**P-value**	**Supported or Not**
H1	EB → IB	0.046	Supported
H2	CB → IB	0.032	Supported
H3	HU → IB	0.000	Supported
H4	HR → IB	0.064	Not Supported
H5	NS → IB	0.010	Supported

H1: There is a significant relationship between Emotional Biases and Investor Behaviour.

The path coefficient for the relationship between the Emotional Bias and Investor Behaviour is highly significant (p-value = 0.046). so, the null hypothesis is rejected at 5% significant level. this result support the strong influence of emotional biases on investor behavior during market crash. Which means, if anyone make a decision in turbulent times, their decisions not completely rational, their emotions such as fear, anxiety, or overconfidence definitely influence in their decisions. Simply, the decision may be out of their emotions. The result indicating the view that during extreme market volatility, investors tend to react emotionally rather than logically, which can lead to either impulsive decisions or inaction.

H2: There is a significant relationship between Cognitive Biases and Investor Behaviour.

The cognitive biases towards investor behaviour path also demonstrated a significant effect with a p-value of 0.032. This finding suggests that cognitive biases, such as confirmation bias, anchoring bias, false consensus effect, hallow effect, misinformation effect, Loss-aversion bias and Overconfidence bias lead investors to make decisions based on preconceived notions or past experiences. During high market fluctuations, cognitive biases may prevent investors from accurately assessing

risk and making rational decisions, contributing to either overly cautious or excessively risky behaviours.

The significance of both emotional and cognitive biases underscores the importance of Controlling the psychological factors while making quick decision during market crash. Emotions, whether positive or negative, can cloud judgment and lead to irrational decision-making. Similarly, cognitive biases can distort the way information is processed, leading to faulty conclusions about market conditions. Various studies already state the existence of emotional and cognitive biases in investor behaviour.Thus, these results reinforce the findings of previous studies, including those by, Mudunuri, Padmanabha, Raju, Chokkamreddy, & Prakash (2024), Syed, Ibtasam, & Shafqat (2024), K, Arjun, Goud., Dr., K., V., R., Satya, Kumar., & Dr., P. Chakradhar. (2024),Sahi SK (2017)&Ning Tang (2021).The study suggest that interventions aimed at reducing emotional and cognitive biases, such as behavioural coaching or financial literacy programs, could help investors make more rational decisions even in times of crisis.

H3: There is a significant relationship between Heuristics and Investor Behaviour.

The influence of heuristics on investor behaviour was found to be significant even at 1% significant level (p-value = 0.000). Investors often rely on mental shortcuts or "rules of thumb" to make quick decisions during high market fluctuations. This can be due to the overwhelming nature of such events, where investors may feel the need to act quickly without thoroughly analyzing all available information. The decision may be executed within a very short period of time. So, once they are thinking rationally the loss may be occurred. the significance of this result highlights that heuristics can lead to both beneficial and detrimental investment decisions, depending on the context.

Heuristics can sometimes lead to efficient decision-making, they also carry the risk of oversimplifying complex situations, leading to poor outcomes. Furthermore, the results indicate a relationship between heuristics and investor behaviour, consistent with findings from previous studies on heuristic behaviour, including those by, Marcelina, Piotrowski., Christian, & Bünnings. (2022), Jinesh Jain , et al. (2023), Mohan, Prasad & Sapkota., Dhan, Raj, Chalise (2023)&Sydney, Ferreira, Santos., Rodolfo, Leandro, de, Faria, Olivo., George, André, Willrich, Sales., & Fabiana, Lopes, da, Silva. (2023).

H4: There is a significant relationship between Herding and Investor Behaviour.

Herding can exacerbate market trends, leading to bubbles or crashes, as investors abandon individual analysis in favour of group sentiment. This behaviour is particularly pronounced in moments of uncertainty when investors look to others for cues on how to act. In this study, the relationship between Herding and investor behaviour was not significant (p-value = 0.064). This study suggests that during market crash, investors tend to make decisions based on their own analysis or decision rather than simply follow the crowd.

Several previous studies also suggest limited or no significant relationship between Herding and investor behaviour. Research by Eric C. Chang, Joseph W. Cheng, & Ajay Khorana (2000) examines the investor behaviour of market participants within different international markets such as, US, Hong Kong, Japan. South Korea and Taiwan. It suggests no evidence of herding on investor behaviour among US and Hong Kong investors partial evidence of the influence of herding in Japan and evidence from South Korea and Taiwan shows a significant relationship between herding and investor behaviour. One review paper (Ashish, Garg., Kiran, & Jindal, 2014) discussed several studies among Indian investors, that indicates weak or no relationship between herding and investor behaviour.

The tendency to follow the crowd does not exist in this study indicates that, most of the investors would like to make decision by their own. This behaviour indicates that investors may benefit from strategies that promote independent thinking and critical analysis, especially during periods of market turmoil. the study is based on sample survey focused in one state. Even the major portion of a single stock market is out of the study. So, this finding cannot be generalised. However, the overall results can help to understand the neuro-psychological influence in investor behaviour.

H5: There is a significant relationship between Neurotransmitters and Investor Behaviour.

Most importantly, the result of path analysis clearly states Neurotransmitters (P – Value: 0.010) have a significant relationship with Investor behaviour. this result supports Hypothesis 5, The neuro-biological processes play a significant role in investors behaviour to unexpected market events. Neurotransmitters composed of dopamine, serotonin, epinephrine and norepinephrine which may have relation with investor behaviour. Neurotransmitters can heighten emotions like euphoria or fear, which in turn affect decision-making processes. For instance, heightened dopamine levels may lead to overconfidence and risk-taking, while increased cortisol levels could trigger panic and risk aversion.

Most importantly, the release of neurotransmitters significantly influences in investor behaviour during highly volatile market conditions. It is difficult to draw a direct causal link between the release of neurotransmitters and investor behaviour during market fluctuations. While neurotransmitters play a crucial role in brain function and decision-making, investor behaviour during such events is complex and influenced by a multitude of factors beyond biological processes.

II. CONCLUSION

Neurofinanceintegrates psychology, neuroscience, and finance for explaining financial behavior. This approach provides a better understanding of neuro-psychological mechanisms in financial decision making. Understanding these neurochemical mechanisms helps to develop better decision-making behaviour that is based only on rational factors and various analysis. This study contributes to the growing field of neurofinance by explaining the psychological and neurological influence in investor behavior during market crash. The results confirm that biases, heuristics, and neurotransmitters play a significant role in investor behaviour towards unexpected events. However, Herding behaviour does not influence investor behaviour. By moving beyond the traditional rationalist models, this research highlights the need for more comprehensive studies that cover all rational and neuro-psychological aspects of investor behaviour.

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